

What is claimed is:

5v6 B
C'
1 A method of reducing jitter in a shared-media packet-switched access network offering
2 integrated Internet Protocol voice and data services comprising the steps of:
3 transmitting packets in an upstream channel in a frame,
4 and
5 establishing at least two non-overlapping jitter windows in said frame for carrying
6 voice packets.

1 2. The method of claim 1 further comprising the step of:
2 dividing said frame into a sequence of one or more voice regions and one or more
3 data-only regions, and
4 establishing said at least two non-overlapping jitter windows in said one or more
5 voice regions.

1 3. The method of claim 2 wherein said step of establishing at least two non-overlapping
2 jitter windows in said one or more voice regions further includes:
3 establishing two jitter windows,
4 where n is the number of time slots in said one or more voice regions, defining the
5 length of each of said two non-overlapping jitter windows as $n/2$ for an even number
6 of time slots in the voice region, or

7 for an odd number of time slots in said one or more voice regions, defining the
8 length of one non-overlapping jitter window as $(n-1)/2$, and the length of the other
9 jitter window as $(n+1)/2$.

1 4. The method of claim 1 wherein said shared-media packet-switched access network is
2 connected to a distribution plant comprising one of hybrid fiber-coaxial, coaxial, or
3 fiber-to-the-curb.

1 5. The method of claim 2 wherein said jitter windows are established in one voice region.

1 6. The method of claim 2 wherein said jitter windows are established in two voice
2 regions separated by a data-only region.

1 7. The method of claim 1 wherein said step of establishing at least two non-overlapping
2 jitter windows further includes:
3 establishing more than two non-overlapping jitter windows.

1 8. The method of claim 7 wherein the lengths of each of said more than two non-
2 overlapping jitter windows are approximately equal.

1 9. A method of allocating upstream channel bandwidth in a shared-media packet-
2 switched access network offering integrated Internet Protocol voice and data services
3 comprising the steps of:

4 selecting an upstream channel with at least one idle time slot to accommodate a
5 new voice connection and one or more existing voice connections,

6 assigning time slots in said upstream channel to carry voice packets generated from
7 said new and existing voice connections, voice packets generated from said one or
8 more existing voice connections, and previously assigned to one jitter window, being
9 maintained in the same jitter window in the selected upstream channel.

1 10. The method of claim 9 wherein said step of selecting an upstream channel further
2 includes selecting an upstream channel, and

3 (1) the number of idle time slots in each jitter window in said selected upstream
4 channel being no less than the number of idle time slots allocated to a corresponding
5 jitter window in a current channel accommodating existing voice connections, and

6 (2) at least one of the jitter windows in said selected channel accommodating voice
7 packets from said new and existing voice connections.

1 11. The method of claim 9 wherein said step of selecting an upstream channel further
2 includes selecting one of a packed with first fit, minimally packed or maximally spread
3 upstream channel.

1 12. The method of claim 9 wherein said step of assigning time slots further includes
2 assigning an idle time slot for said new voice connection by selecting one of a lowest
3 idle time slot, a highest idle time slot or randomly selecting an idle time slot.

1 13. The method of claim 9 wherein said voice connections are constant-bit-rate voice
2 connections.

1 14. A method of allocating upstream channel bandwidth in a shared-media packet-
2 switched access network offering integrated Internet Protocol voice and data services
3 comprising the steps of:

4 assigning an upstream channel for transmitting voice packets generated from a new
5 voice connection on a call-by-call basis.

1 15. The method of claim 14 further comprising the step of:

2 assigning time slots in said upstream channel to carry said voice packets.

1 16. The method of claim 14 further comprising the step of:

2 selecting an upstream channel using one of packed with first fit, minimally packed
3 or maximally spread techniques to select said upstream channel.

1 17. The method of claim 15 wherein said step of assigning time slots further includes
2 assigning an idle time slot for said new voice connection by selecting one of a lowest
3 idle time slot, a highest idle time slot or randomly selecting an idle time slot.

1 18. A shared-media packet-switched access network offering integrated Internet Protocol
2 voice and data services comprising:

3 a cable modem located at a customer-end of an access network;

4 a cable modem termination system located at a head-end of an access network,
5 at least one upstream channel for transmitting voice and data packets from said
6 cable modem to said cable modem termination system; wherein
7 said packets are transmitted in a frame, wherein said frame comprises at least two
8 non-overlapping jitter windows for carrying said voice packets.

1 19. The network of claim 18, wherein said frame includes one or more voice regions, and
2 said at least two jitter windows are included in said one or more voice regions.

1 20. The network of claim 18, wherein said frame comprises two non-overlapping jitter
2 windows in two voice regions, n being the number of time slots in the voice region,
3 defining the length of each of said two non-overlapping jitter windows as $n/2$ for an
4 even number of time slots in the voice region, or
5 for an odd number of time slots in the voice region, defining the length of one non-
6 overlapping jitter window as $(n-1)/2$, and the length of the other jitter window as
7 $(n+1)/2$.

1 21. The network of claim 18, wherein said cable modem termination system assigns said at
2 least one upstream channel to said cable modem by selecting one of one of a packed
3 with first fit, minimally packed or maximally spread upstream channel.

1 22. The network of claim 18, wherein said cable modem termination system selects one of
2 a lowest idle time slot, a highest idle time slot or randomly selecting an idle time slot to
3 carry said voice packets.

1 23. The network of claim 18, wherein said cable modem termination system assigns a new
2 upstream channel, with at least one idle time slot, to said cable modem when said at
3 least one upstream channel cannot accommodate a new voice connection from said
4 cable modem.

1 24. The network of claim 23, wherein said cable modem termination system selects said
2 new upstream channel based on the following:

3 (1) the number of idle time slots in each jitter window in said new upstream
4 channel being no less than the number of idle time slots allocated to a corresponding
5 jitter window in a current channel accommodating existing voice connections, and

6 (2) at least one of the jitter windows in said new upstream channel can
7 accommodate voice packets from said new and existing voice connections.

1 25. The network of claim 18, wherein said access network includes one of hybrid fiber
2 coaxial, coaxial or fiber-to-the-curb.

1 26. The network of claim 19, wherein said at least two non-overlapping jitter windows
2 includes more than two non-overlapping jitter windows.

1 27. The network of claim 26, wherein the lengths of each of said more than two non-
2 overlapping jitter windows are approximately equal.

1 ~~28.~~ A shared-media packet-switched access network offering integrated Internet Protocol
2 voice and data services comprising:

3 at least one upstream channel for transmitting voice and data packets to said cable
4 modem termination system; wherein

5 said packets are transmitted in frames, and each of said frames comprises two non-
6 overlapping jitter windows for carrying voice packets.

1 ~~29.~~ A method of allocating upstream channel bandwidth in a shared-media packet-
2 switched access network offering integrated Internet Protocol voice and data services
3 comprising the steps of:

4 selecting a maximally spread upstream channel for transmitting voice packets
5 generated from a new voice connection, and

6 assigning a random idle time slot in the selected maximally spread upstream
7 channel to carry said voice packets.

1 30. The method of claim 29 further comprising the step of:

2 searching for said maximally spread channel by searching upward from a first
3 upstream channel when said new voice connection is the first established voice
4 connection.

1 31. The method of claim 30 wherein said step of searching for said maximally spread
2 channel further includes searching downward from the last upstream channel when
3 said new voice connection is not the first established voice connection.

1 32. A method of assigning a cable modem requesting bandwidth to accommodate a new
2 call, wherein said cable modem requesting bandwidth is assigned to a current upstream
3 channel and has at least one existing call, to an upstream channel to accommodate said
4 new and said at least one existing call comprising:

5 searching for a cable modem assigned to said current channel with the least
6 number of calls,

7 assigning a new upstream channel to a cable modem with the least number of calls.

1 33. The method of claim 32 further comprising:

2 determining whether the cable modem with the least number of calls is said cable
3 modem requesting bandwidth.

1 34. The method of claim 33 further comprising:

2 moving said cable modem with the least number of calls to said new upstream
3 channel, if said cable modem with the least number of calls is not said cable modem
4 requesting bandwidth.

1 35. The method of claim 33 further comprising:

- 2 randomly selecting a cable modem with the least number of calls if more than one
3 cable modem assigned to said current channel has the least number of calls and said
4 cable modem requesting bandwidth does not have the least number of calls.
-